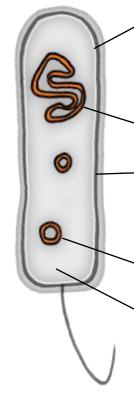


cytoplasm	<i>site of chemical reactions in the cell</i>	gel like substance containing enzymes to catalyse the reactions
nucleus	<i>contains genetic material</i>	controls the activities of the cell and codes for proteins
cell membrane	<i>semi permeable</i>	controls the movement of substances in and out of the cell
ribosome	<i>site of protein synthesis</i>	mRNA is translated to an amino acid chain
mitochondrion	<i>site of respiration</i>	where energy is released for the cell to function

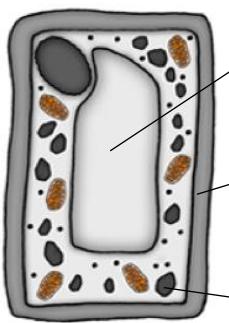
animal cell



cell membrane	<i>site of chemical reactions in the cell</i>	gel like substance containing enzymes to catalyse the reactions
bacterial DNA	<i>not in nucleus floats in the cytoplasm</i>	controls the function of the cell
cell wall	NOT made of cellulose	supports and strengthens the cell
plasmid	<i>small rings of DNA</i>	contain additional genes
cytoplasm	<i>semi permeable</i>	controls the movement of substances in and out of the cell

Bacterial cells are much smaller than plant and animal cells

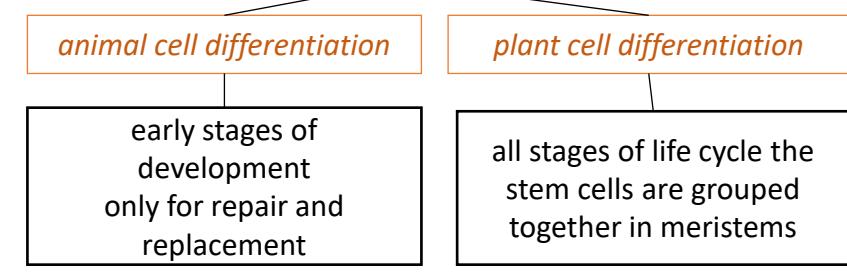
plant cell



contains all the parts of animal cells plus extras

permanent vacuole	<i>contains cell sap</i>	keeps cell turgid, contains sugars and salts in solution
cell wall	<i>made of cellulose</i>	supports and strengthens the cell
chloroplast	<i>site of photosynthesis</i>	contains chlorophyll, absorbs light energy

how a cell changes and becomes specialised
Undifferentiated cells are called **STEM** cells



AQA Cell Structure

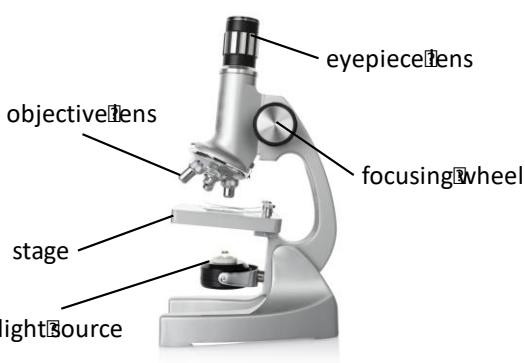
Prokaryotes simpler organisms

Specialised cells

specialised animal cells	nerve		<i>carry electrical signals</i>	long branched connections and insulating sheath
	sperm		<i>fertilise an egg</i>	streamlined with a long tail acrosome containing enzymes large number of mitochondria
	muscle		<i>contract to allow movement</i>	contains a large number of mitochondria long
specialised plant cells	root hair		<i>absorb water and minerals from soil</i>	hair like projections to increase the surface area
	xylem		<i>carry water and minerals</i>	TRANSPIRATION - dead cells cell walls toughened by lignin flows in one direction
	phloem		<i>carry glucose</i>	TRANSLOCATION - living cells cells have end plates with holes flows in both directions

Microscopy

$$\text{magnification} = \frac{\text{size of image}}{\text{real size of the object}}$$

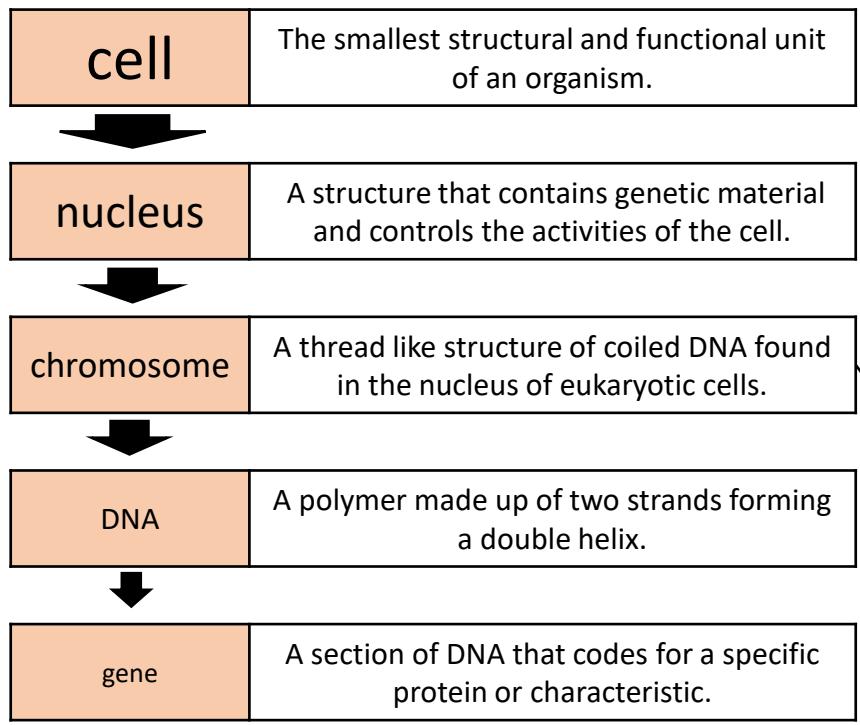


Feature	Light (optical) microscope	Electron microscope
Radiation used	Light rays	Electron beams
Max magnification	~ 1500 times	~ 2 000 000 times
Resolution	200nm	0.2nm
Size of microscope	Small and portable	Very large and not portable
Cost	~£100 for a school one	Several £100,000 to £1 million plus

PREFIXES

Prefix	Multiple	Standard form
centi (cm)	1 cm = 0.01 m	$\times 10^{-2}$
milli (mm)	1 mm = 0.001 m	$\times 10^{-3}$
micro (µm)	1 µm = 0.000 001 m	$\times 10^{-6}$
nano (nm)	1nm = 0.000 000 001 m	$\times 10^{-9}$

largest
↑
smallest



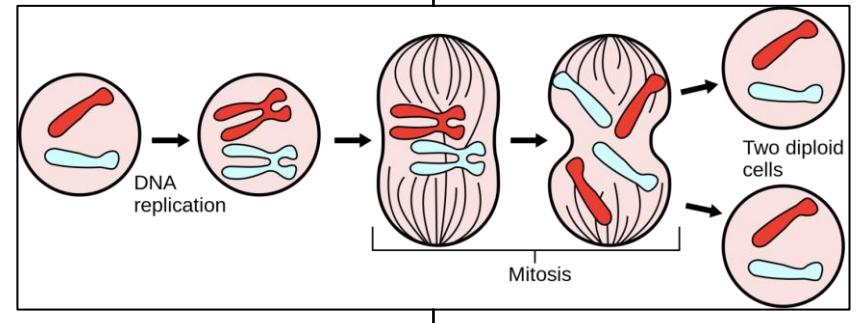
Small intestines	<i>Villi – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.</i>
Lungs	<i>Alveoli– increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.</i>
Gills in fish	<i>Gill filaments and lamella – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.</i>
Roots	<i>Root hair cells - increase surface area.</i>
Leaves	<i>Large surface area, thin leaves for short diffusion path, stomata on the lower surface to let O₂ and CO₂ in and out.</i>

ADAPTATIONS FOR DIFFUSION – The greater the difference in concentrations the faster the rate of diffusion.

Cells divide in a series of stages. The genetic material is doubled and then divided into two identical cells.

MITOSIS AND THE CELL CYCLE

Stage 1	Growth	Increase the number of sub-cellular structures e.g. ribosomes and mitochondria.
Stage 2	DNA Synthesis	DNA replicates to form two copies of each chromosome.
Stage 3	Mitosis	One set of chromosomes is pulled to each end of the cell and the nucleus divides. Then the cytoplasm and cell membranes divide to form two cells that are identical to the parent cell.



Mitosis occurs during growth, repair, replacement of cells. Asexual reproduction occurs by mitosis in both plants & simple animals.

AQA Cell Biology 2

Cell division

STEM CELLS

Undifferentiated cell of an organism

Divides to form more cells of the same type, and can differentiate to form many other cell types.

Transport in cells

Diffusion <i>No</i> energy required	<i>Movement of particles in a solution or gas from a higher to a lower concentration</i>	E.g. O ₂ and CO ₂ in gas exchange, urea in kidneys. Factors that affect the rate are concentration, temperature and surface area.
Osmosis <i>No</i> energy required	<i>Movement of water from a dilute solution to a more concentrated solution</i>	E.g. Plants absorb water from the soil by osmosis through their root hair cells. Plants use water for several vital processes including photosynthesis and transporting minerals.
Active transport ENERGY required	<i>Movement of particles from a dilute solution to a more concentrated solution</i>	E.g. movement of mineral ions into roots of plants and the movement of glucose into the small intestines.

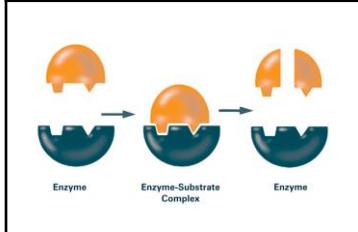
Human Embryonic stem cells	<i>Can be cloned and made to differentiate into most cell types</i>	Therapeutic cloning uses same genes so the body does not reject the tissue. Can be a risk of infection
Adult bone marrow stem cells	<i>Can form many types of human cells e.g. blood cells</i>	Tissue is matched to avoid rejection, risk of infection. Only a few types of cells can be formed.
Meristems (plants)	<i>Can differentiate into any plant cell type throughout the life of the plant.</i>	Used to produce clones quickly and economically, e.g. rare species, crop plants with pest /disease resistance

Treatment with stem cells may be able to help conditions such as diabetes and paralysis. Some people object to the use of stem cells on ethical or religious grounds

Enzymes catalyse (increase the rate of) specific reactions in living organisms

An organ system in which organs work together to digest and absorb food.

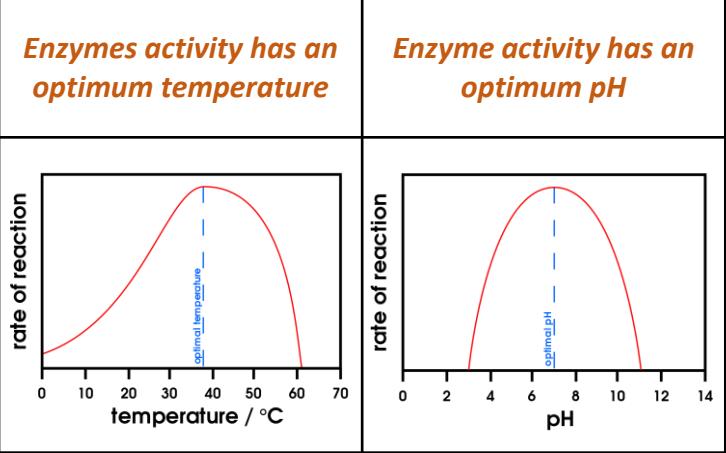
The 'lock and key theory' is a simplified model to explain enzyme action



Enzymes catalyse specific reactions in living organisms due to the shape of their active site

Digestive enzymes speed up the conversion of large insoluble molecules (food) into small soluble molecules that can be absorbed into the bloodstream

The activity of enzymes is affected by changes in temperature and pH



Large changes in temperature or pH can stop the enzyme from working (denature)

<i>Temperature too high</i>	<i>pH too high or too low</i>
Enzyme changes shape (denatures) the substrate no longer fits the active site.	

Enzymes in digestion

The human digestive system

AQA GCSE ORGANISATION Part 1

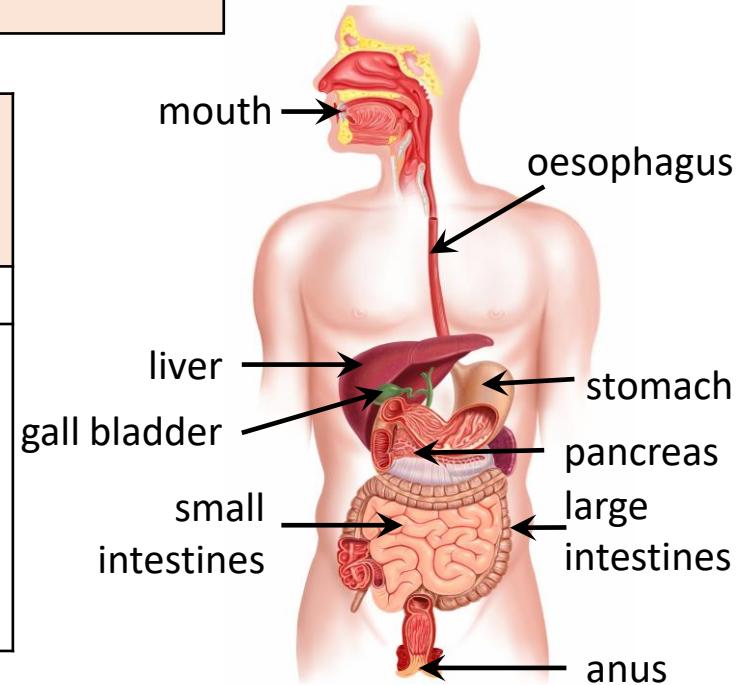
Principles of organisation

Non-communicable diseases

More energy consumed in food and drink than used
obesity
Linked to increased rates of cardiovascular disease and development of diabetes type 2.

Food tests

Sugars (glucose)	<i>Benedict's test</i>	Orange to brick red precipitate.
Starch	<i>Iodine test</i>	Turns black.
Biuret	<i>Biuret reagent</i>	Mauve or purple solution.

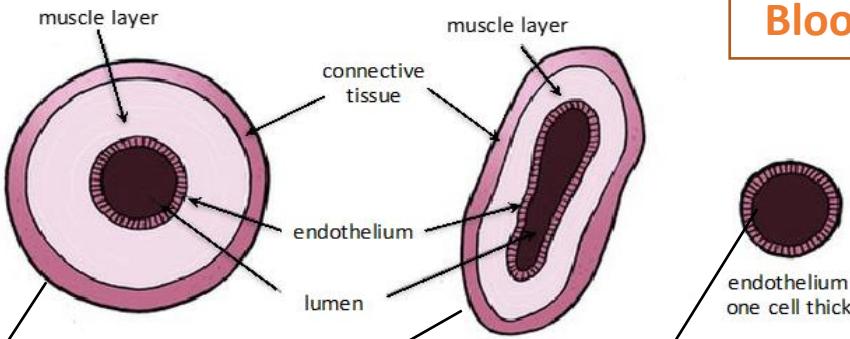


Carbohydrases (e.g. amylase)		<i>Made in salivary glands, pancreas, small intestine</i>	Break down carbohydrates to simple sugar (e.g. amylase breaks down starch to glucose).
Proteases		<i>Made in stomach, pancreas</i>	Break down protein to amino acids.
Lipases		<i>Made in pancreas (works in small intestine)</i>	Break down lipids (fats) to glycerol and fatty acids.
Bile (not an enzyme)		<i>Made in liver, stored in gall bladder.</i>	Emulsifies lipids to increase surface area to increase the rate of lipid break down by lipase. Changes pH to neutral for lipase to work

The products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used for respiration.

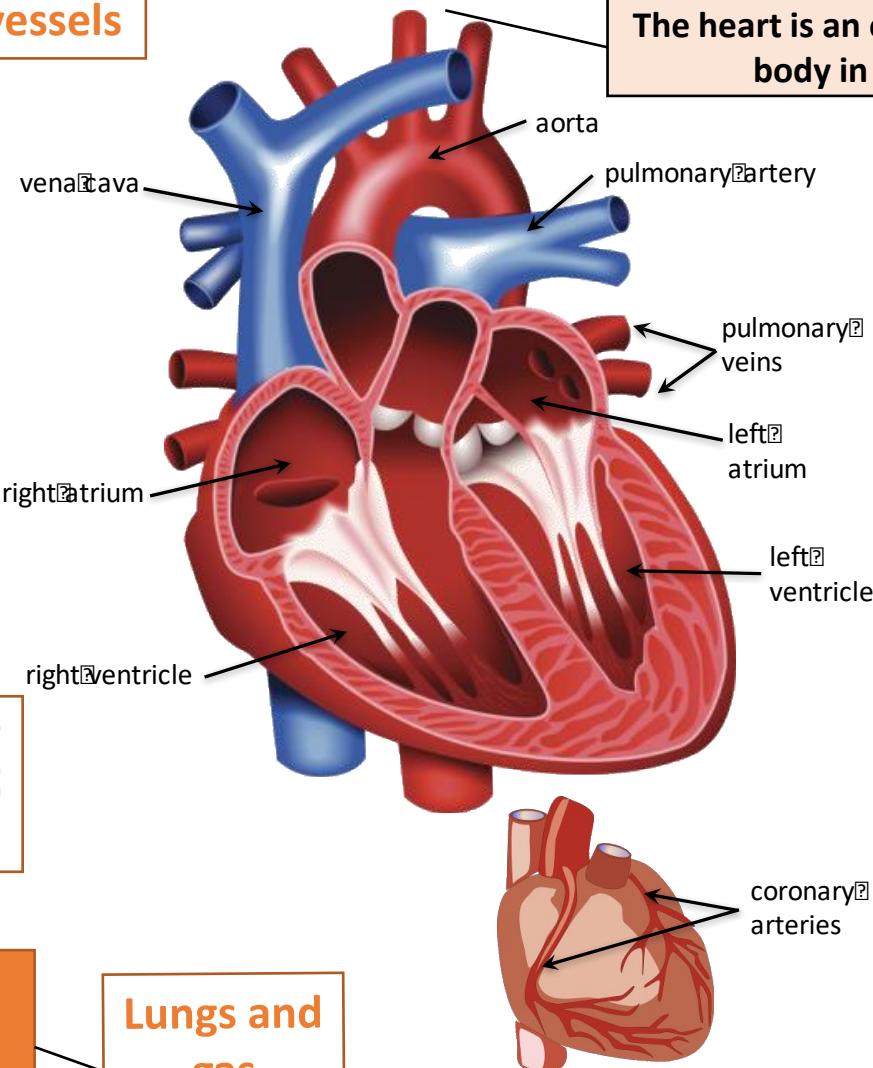
Cells, tissues, organs and systems

Cells		<i>e.g. muscle cells</i>	The basic building blocks of all living organisms.
Tissues		<i>e.g. muscle tissue</i>	A group of cells with a similar structure and function.
Organs		<i>e.g. the heart</i>	Aggregations (working together) of tissues performing a specific function.
Organ systems		<i>e.g. the circulatory system</i>	Organs working together to form organ systems, which work together to form an organism.



Blood vessels

The heart is an organ that pumps blood around the body in a double circulatory system



Different structure in the heart have different functions	<i>Right ventricle</i>	Pumps blood to the lungs where gas exchange takes place.
	<i>Left ventricle</i>	Pumps blood around the rest of the body.
	<i>Pacemaker (in the right atrium)</i>	Controls the natural resting heart rate. Artificial electrical pacemakers can be fitted to correct irregularities.
	<i>Coronary arteries</i>	Carry oxygenated blood to the cardiac muscle.
	<i>Heart valves</i>	Prevent blood in the heart from flowing in the wrong direction.

Artery	Vein	Capillary
<i>Carry blood away from the heart</i>	<i>Carry blood to the heart</i>	<i>Connects arteries and veins</i>
Thick muscular walls, small lumen, carry blood under high pressure, carry oxygenated blood (except for the pulmonary artery).	Thin walls, large lumen, carry blood under low pressure, have valves to stop flow in the wrong direction, carry deoxygenated blood (except for the pulmonary vein).	One cell thick to allow diffusion, Carry blood under very low pressure.

Heart

Blood

Blood is a tissue consisting of plasma, in which blood cells, white blood cells and platelets are suspended

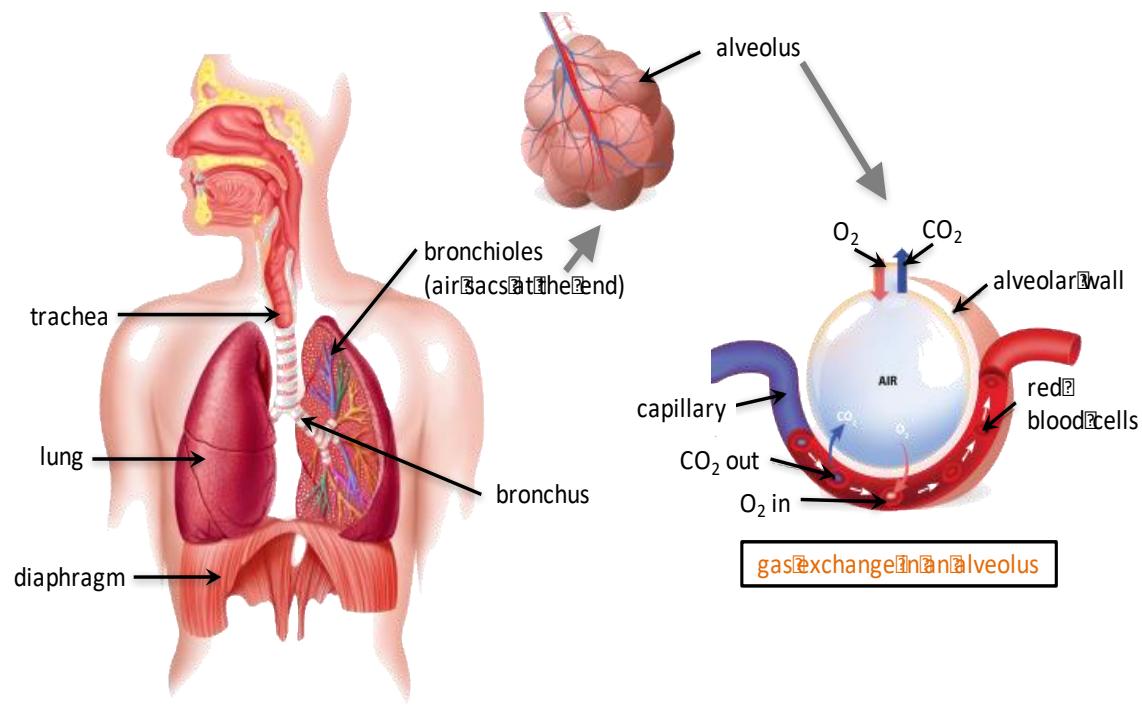
AQA GCSE ORGANISATION part 2

Lungs and gas exchange

The heart pumps low oxygen/high carbon dioxide blood to the lungs

Plasma (55%)	<i>Pale yellow fluid</i>	Transports CO ₂ , hormones and waste.
Red blood cells (45%)	<i>Carries oxygen</i>	Large surface area, no nucleus, full of haemoglobin.
White blood cells (<1%)	<i>Part of the immune system</i>	Some produce antibodies, others surround and engulf pathogens.
Platelets (<1%)	<i>Fragments of cells</i>	Clump together to form blood clots.

Trachea	<i>Carries air to/from the lungs</i>	Rings of cartilage protect the airway.
Bronchioles	<i>Carries air to/from the air sacs (alveoli)</i>	Splits into multiple pathways to reach all the air sacs.
Alveoli	<i>Site of gas exchange in the lungs</i>	Maximises surface area for efficient gas exchange.
Capillaries	<i>Allows gas exchange between into/out of blood</i>	Oxygen diffuses into the blood and carbon dioxide diffuses out.

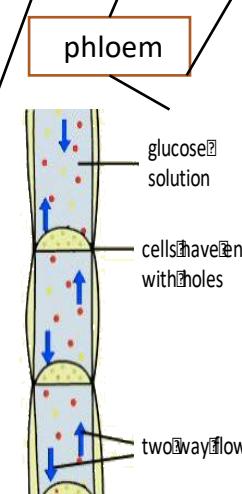
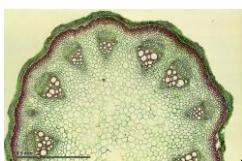
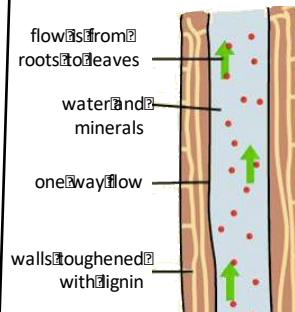
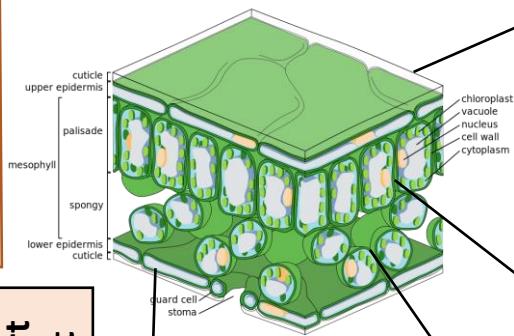


gas exchange in an alveolus

Disease	Cause	Effect	Treatment
Coronary heart disease (CHD)	<i>A build up for fatty substances in the coronary arteries (atherosclerosis)</i>	Oxygen-ated blood cannot get to the cardiac muscle.	Stents: inserted into the blocked artery to open it up. Statins: lower harmful cholesterol.
Faulty heart valves	<i>Valves don't open or close properly</i>	Blood can leak or flow in the wrong direction	Biological valve transplant or a mechanical valve can be inserted

Plant organ systems

The roots, stem and leaves form a plant organ system for transport of substances around the plant



Epidermal tissues	<i>Waxy cuticle (top layer of the leaf)</i>	Reduces water loss from the leaf
	<i>Guard cells and stomata</i>	Guard cells open and close the stomata to control water loss and allow for gas exchange (oxygen and carbon dioxide).
Palisade mesophyll	<i>Palisade cells</i>	Cells near the top surface of the leaf that are packed with chloroplasts that contain chlorophyll. Both adaptations maximize photosynthesis.
Spongy mesophyll	<i>Air spaces in the leaf between cells</i>	Increased surface area for gas exchange so that carbon dioxide can diffuse into photosynthesising cells.
xylem	<i>Hollow tubes strengthened by lignin adapted for the transportation of water in the transpiration stream</i>	Allows transport of water and mineral ions from the roots to the stem and the leaves.
phloem	<i>Cell sap moves from one phloem cell to the next through pores in the end walls</i>	Transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage (translocation).
Meristem tissue	<i>New cells (roots and shoot tips) are made here including root hair cells</i>	Root hair cells have an increased surface area for the uptake of water by osmosis, and mineral ions by active transport.

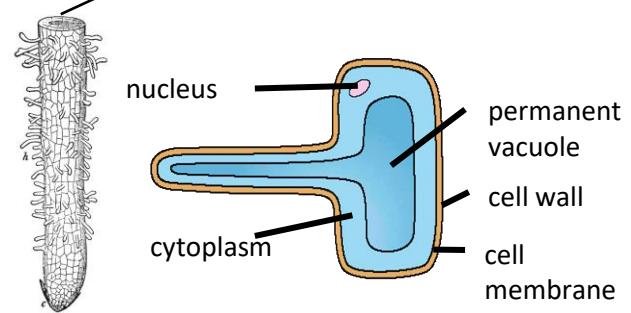
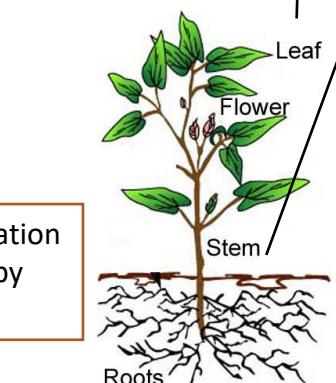
Cancer
Non-communicable diseases
The result of changes in DNA that lead to uncontrolled growth and division

Benign tumour	Contained in one area of the body (usually by a membrane) – not cancer.
Malignant tumour	Invasively spread to different parts of the body to form secondary tumours.

Some cancers have genetic risk factors. Carcinogens and ionising radiation increase the risk of cancer by changing/ damaging DNA

Risk factors for heart/lung disease and certain types of cancer include drinking alcohol, diet, obesity and smoking

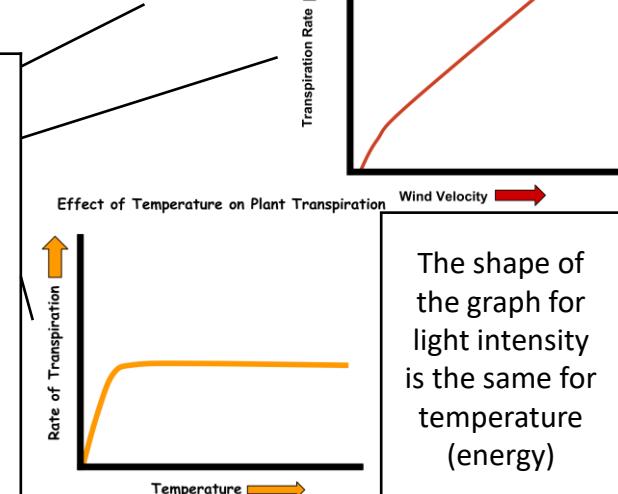
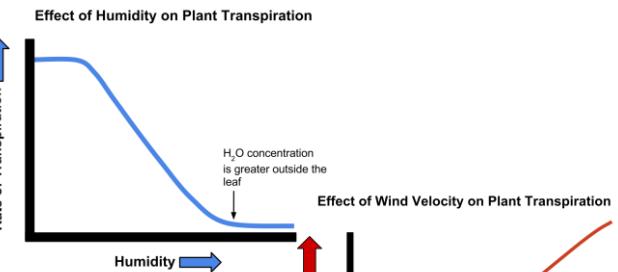
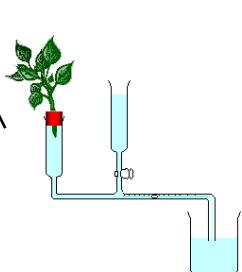
These risks factors can also affect the brain, liver and the health of unborn babies



A potometer is used to measure the amount of water lost over time (rate of transpiration)

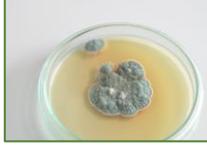
Transpiration

Transpiration
The rate at which water is lost from the leaves of a plant. The transpiration stream is the column of water moving through the roots, stem and leaves
Temperature, humidity, air movement and light intensity affect the rate of transpiration.



The shape of the graph for light intensity is the same for temperature (energy)

Traditionally drugs were extracted from plants and microorganisms

<i>Digitalis</i>	<i>Aspirin</i>	<i>Penicillin</i>
Extracted from foxglove plants and used as a heart drug	A painkiller and anti-inflammatory that was first found in willow bark	Discovered by Alexander Fleming from the <i>Penicillium</i> mould and used as an antibiotic
		

Most new drugs are synthesised by chemists in the pharmaceutical industry.

Drugs have to be tested and trialled before to check they are safe and effective

Antibiotics and painkillers

Bacteria can mutate

Sometimes this makes them resistant to antibiotic drugs.

Antibiotics have greatly reduced deaths from infectious bacterial disease

antibiotics	<i>e.g. penicillin</i>	Kill infective bacteria inside the body. Specific bacterial infections require specific antibiotics.
Painkillers and other medicines	<i>e.g. aspirin, paracetamol, ibuprofen</i>	Drugs that are used to treat the symptoms of a disease. They do not kill pathogens

Antibiotics cannot be used to treat viral pathogens

It is difficult to develop drugs to kill viruses without harming body tissues because viruses live and reproduce inside cells

Discovery and drug development

AQA INFECTION AND RESPONSE

Vaccination

Used to immunise a large proportion of the population to prevent the spread of a pathogen

New drugs are extensively tested for:

Efficacy	Make sure the drug works
Toxicity	Check that the drug is not poisonous
Dose	The most suitable amount to take



Double blind trial: patients and scientists do not know who receives the new drug or placebo until the end of the trial. This avoids bias.

Vaccination	<i>Small amount of dead or inactive form of the pathogen</i>	<i>1st infection by pathogen</i>	White blood cells detect pathogens in the vaccine. Antibodies are released into the blood.
		<i>Re-infection by the same pathogen</i>	White blood cells detect pathogens. Antibodies are made much faster and in larger amounts.

A person is unlikely to suffer the symptoms of the harmful disease and it's spread in a population is prevented

Preclinical trials - using cells, tissues and live animals - must be carried out before the drug can be tested on humans.

Clinical trials use healthy volunteers and patients

Created more side effects than expected (fatal in some cases) and are not as widely used as everybody hoped when first developed.

Stage 1	Stage 2	Stage 3	Stage 4
Healthy volunteers try small dose of the drug to check it is safe record any side effects	A small number of patients try the drug at a low dose to see if it works	A larger number of patients; different doses are trialled to find the optimum dose	A double blind trial will occur. The patients are divided into groups. Some will be given the drug and some a placebo.

Monoclonal antibodies (Biology only HT)

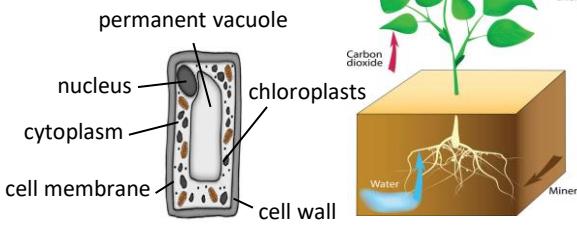
A placebo can look identical to the new drug but contain no active ingredients

Monoclonal antibodies	<i>Identical copies of one types of antibody produced in laboratory</i>	<ol style="list-style-type: none"> 1. A mouse is injected with pathogen 2. Lymphocytes produce antibodies 3. Lymphocytes are removed from the mouse and fused with rapidly dividing mouse tumour cells 4. The new cells are called hybridomas 5. The hybridomas divide rapidly and release lots of antibodies which are then collected
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Monoclonal antibodies can be used in a variety of ways

<i>Diagnosis</i>	<i>Detecting pathogens</i>	<i>Detecting molecules</i>	<i>Treatment</i>
e.g. pregnancy test – measure the level of hormones	Can detect very small quantities of chemicals in the blood	Fluorescent dye can be attached so it can be seen inside cells or tissues	Bound to radioactive substance, toxic drug or chemical Cancer cells are targeted to normal body cells are unharmed

Specific to one binding site on the antigen. Can target specific chemicals or cells in the body



Respiration, stored as insoluble starch, fats or oils for storage, cellulose for cell walls, combine with nitrates from the soil to form amino acids for protein synthesis

Plants use the glucose produced in photosynthesis in a variety of ways

Photosynthetic reaction

The plant manufactures glucose from carbon dioxide and water using energy transferred from the environment to the chloroplasts by light

Photosynthesis	<i>Plants make use of light energy from the environment (ENDOTHERMIC) to make food (glucose)</i>	Carbon dioxide + Water $\xrightarrow{\text{light}}$ Oxygen + Glucose
		$\text{CO}_2 + \text{H}_2\text{O} \xrightarrow{\text{light}} \text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6$

The rate of photosynthesis is affected by temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll

Factor	How the rate is affected	Limiting factors (why the rate stops going up)
Temperature	<i>As the temperature of the environment the plant is in increases rate of photosynthesis increases (up to a point) as there is more energy for the chemical reaction.</i>	Photosynthesis is an enzyme controlled reaction. If the temperature increases too much, then the enzymes become denatured and the rate of reaction will decrease and stop
Light intensity	<i>Light intensity increases as the distance between the plant and the light sources increases. As light intensity increases so does the rate of photosynthesis (up to a point) as more energy is available for the chemical reaction.</i>	At point X another factor is limiting the rate of photosynthesis. This could be carbon dioxide concentration, temperature or the amount of chlorophyll
Carbon dioxide concentration	<i>Carbon dioxide is needed for plants to make glucose. The rate of photosynthesis will increase when a plant is given higher concentrations of carbon dioxide (up to a point).</i>	At point X another factor is limiting the rate of photosynthesis. This could be light intensity, temperature or the amount of chlorophyll
Amount of chlorophyll	<i>Chlorophyll is a photosynthetic pigment that absorbs light and allows the reaction between water and carbon dioxide to occur (photosynthesis)</i>	Another factor could limit the rate of photosynthesis. This could be light intensity, temperature or the carbon dioxide concentration

Control conditions in greenhouses to reduce limiting factors can improve crop yields	Heating	Used to provide optimum temperatures for maximum plant growth.
	Artificial lighting	Enhances the natural sunlight especially overnight and on cloudy days.
	Extra carbon dioxide	Gas can be pumped into the air inside the greenhouse.

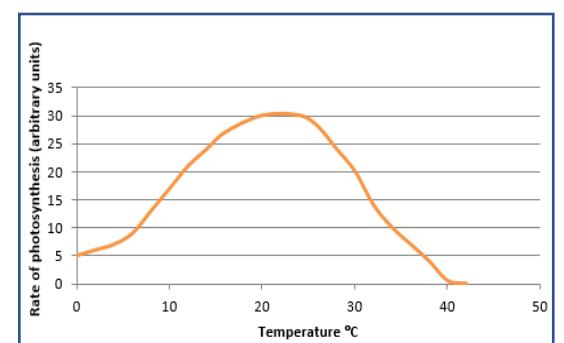
Growers must balance the economics of additional costs of controlling the conditions to maximise photosynthesis with making a profit.



AQA GCSE BIOENERGETICS part 1

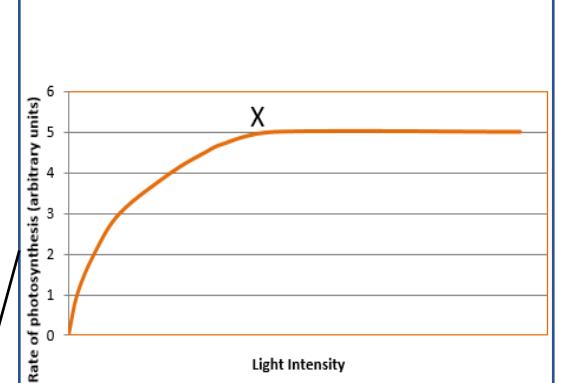
Rate of photosynthesis

Rate of photosynthesis HT Only



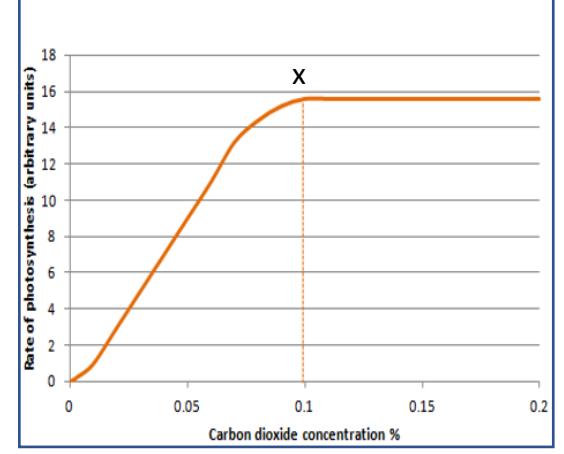
Graph lines C and D: If temperature is increased by 10°C then a slight increase in rate of photosynthesis occurs.

Explain graphs of two or three factors and decide which is the limiting factor

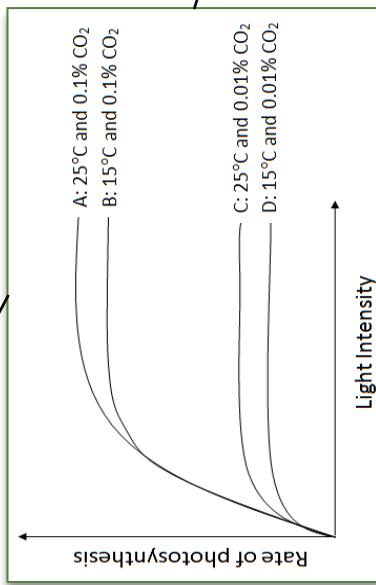


Graph lines A and D: If carbon dioxide concentration and temperature are increased the rate of photosynthesis increases significantly up to a point.

Graph Lines A and B: If carbon dioxide concentration is increased from 0.01% to 0.1% then a large increase in rate occurs up to a point.



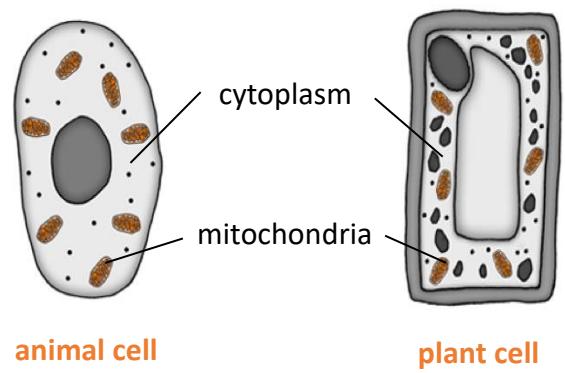
Graph line A: Rate could be limited by temperature and/or amount of chlorophyll. Plant tissue can be damaged when carbon dioxide concentrations exceed 0.1%



Light intensity obeys the inverse square law. This means that if you double the distance between the plant and the light source you quarter the light intensity

During long periods of vigorous activity muscles become fatigued and stop contracting efficiently

An organism will receive all the energy it needs for living processes as a result of the energy transferred from respiration	<i>For movement</i>	Smooth muscle cells	To enable muscles to contract in animals.
	<i>For keeping warm</i>		To keep a steady body temperature in a cold environment.
	<i>For chemical reactions</i>		To build larger molecules from smaller one.



Electron micrograph of a mitochondrion

Response to exercise

During exercise the human body reacts to increased demand for energy	<i>Heart rate increases</i>	Top pump oxygenated blood faster to the muscle tissues and cells.
	<i>Breathing rate and breath volume increase</i>	This increases the amount of oxygen entering the blood stream.

Respiration

AQA GCSE BIOENERGETICS part 2



Cellular respiration is an exothermic reaction which is continuously occurring in all living cells

Anaerobic respiration

Respiration when oxygen is in short supply. Occurs during intensive exercise

During hard exercise, muscle cells are respiring so fast that blood cannot transport enough oxygen to meet their needs.

Glucose is partially oxidised to produce lactic acid which builds up in muscle tissue causing them to become painful and fatigued.

glucose → lactic acid

Aerobic respiration

Respiration with oxygen. Occurs inside the mitochondria continuously

Glucose is oxidised by oxygen to transfer the energy the organism needs to perform its functions.

$$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$$

glucose + oxygen → carbon dioxide + water

Metabolism is the sum of all the reactions in a cell or the body

Metabolism

Metabolism	<i>The energy transferred by respiration in cells is used by the organism for the continual enzyme controlled processes of metabolism.</i>	Conversion of glucose to starch, glycogen and cellulose.
		The formation of lipid molecules from a molecule of glycerol and three molecules of fatty acid.
		The use of glucose and nitrate ions to form amino acids which in turn are used to synthesise proteins.
		Respiration
		Breakdown of excess proteins to form urea for excretion.

Anaerobic respiration in plant and yeast cells

The end products are ethanol and carbon dioxide. Anaerobic respiration in yeast cells is called fermentation

glucose → ethanol + carbon dioxide

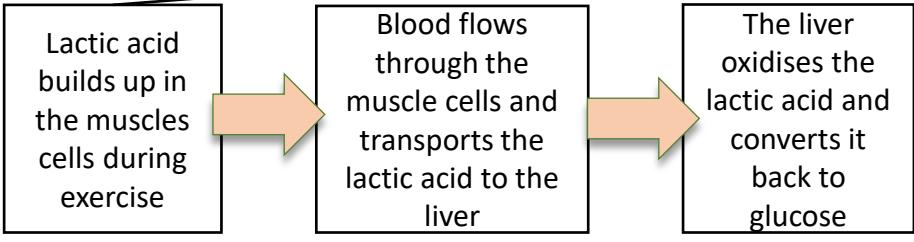
This process is economically important in the manufacture of alcoholic drinks and bread.



Anaerobic respiration releases a much smaller amount of energy than aerobic respiration.

The incomplete oxidation of glucose causes a build up of lactic acid and creates an oxygen debt

The extra amount of oxygen required to remove all lactic acids from cells is called the oxygen debt



Response to exercise HT only

The iris can dilate the pupil (aperture) to let in more light in dim conditions

Sense organ containing receptors sensitive to light intensity and colour

Human control systems include

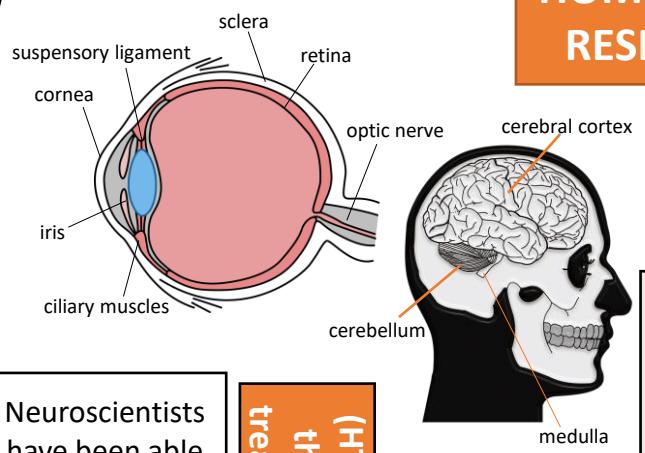
Cells called receptors	Detect stimuli (changes in environment).
Coordination centres	e.g. brain, spinal cord and pancreas that receive information from receptors.
Effectors	Muscles or glands, which bring about responses to restore optimum levels.

Enables humans to react to their surroundings and to co-ordinate their behaviour

Structures of the eye

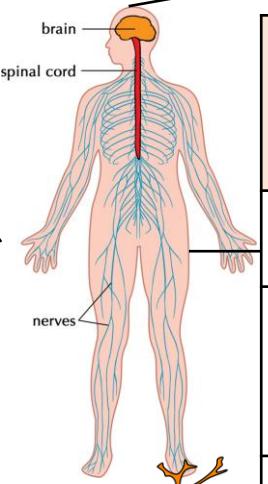
Retina	Light sensitive cell layer.
Optic nerve	Carries impulse to brain.
Sclera	Protects the eye.
Cornea	Transparent layer that covers the pupil and iris.
Iris	Pigmented layer, controls size of pupil.
Ciliary muscles	Controls thickness of lens.
Suspensory ligaments	Connects lens to ciliary muscles.

The Eye (Bio only)



AQA GCSE HOMEOSTASIS AND RESPONSE part 1

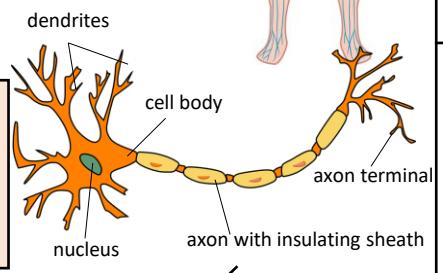
The human nervous system



Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS)
The CNS is the brain and the spinal cord.

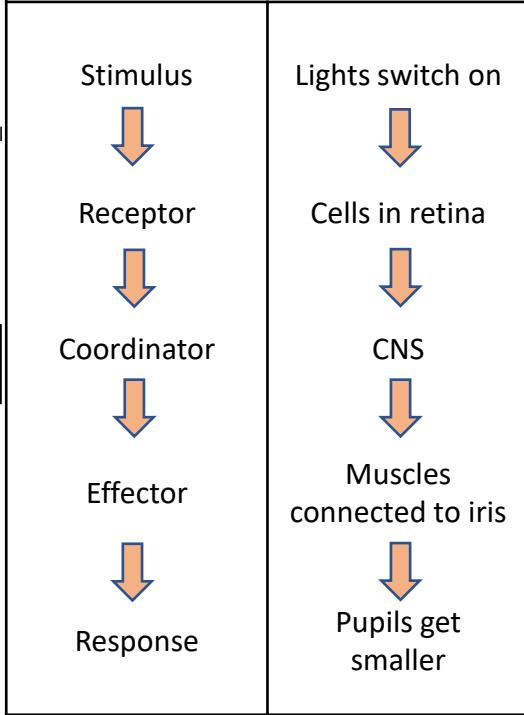
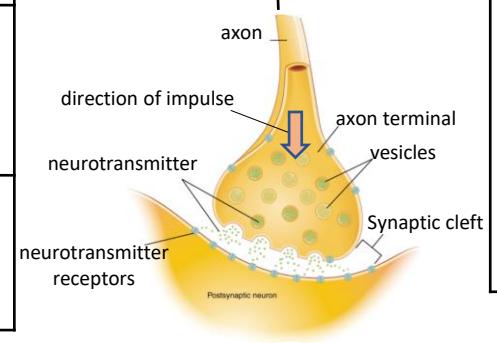
Coordinates the response of effectors; muscles contracting or glands secreting hormones

The Brain (Bio only)
The brain controls complex behaviour. It is made of billions of interconnected neurones.



Typical motor neurone

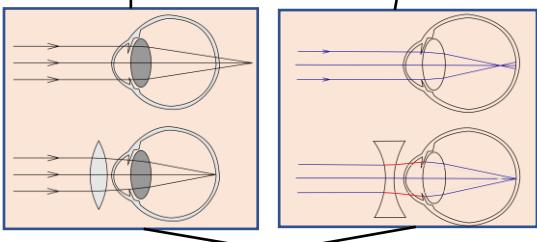
Synapse (gap where two neurones meet).



Accommodation is the process of changing the shape of the lens to focus

Near object	Far object
Ciliary muscles contract, suspensory ligaments loosed, lens get thicker, light is more refracted.	Ciliary muscles relax, suspensory ligaments pulled tight, lens pulled thin, light is only slightly refracted.

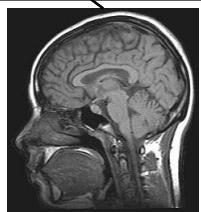
Hyperopia (long sightedness)	Myopia (short sightedness)
Treated using a convex lens so the light is focused on the retina.	Treated using a concave lens so light is focused on the retina.



New technologies now include hard/soft contact lens, laser surgery to change the shape of the cornea and a replacement lens in the eye.

Neuroscientists have been able to map regions of the brain by studying patients with brain damage, electrical stimulation and MRI.

(HT) The complexity and delicacy of the brain makes investigating and treating brain disorders very difficult



The brain has different regions that carry out different functions.

Cerebral cortex	Largest part of the human brain. Higher thinking skills e.g. speech, decision making.
Cerebellum	Balance and voluntary muscle function e.g. walking, lifting.
Medulla	Involuntary (automatic) body functions e.g. breathing, heart rate.

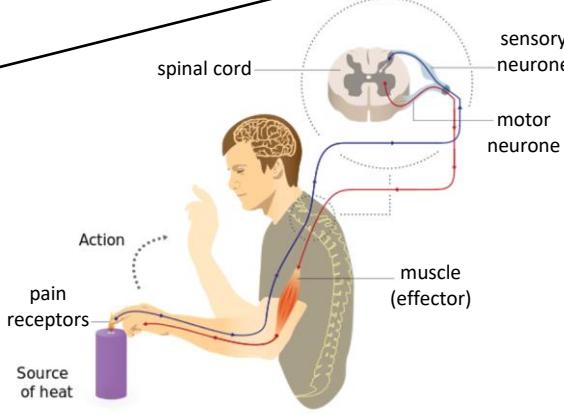
Treating brain damage and disease
e.g. Lobotomy – cutting part of the cerebral cortex

Benefit: thought to alleviate the symptoms of some mental illnesses.

Risks: bleeding in the brain, seizures, loss of brain function. Procedure was abandoned in the 1950s due to risk.

Reflex arc

Receptor	Detect stimuli.
Sensory neurone	Long axon carries impulse from receptor to spinal cord.
Synapse	Gap where neurones meet. Chemical message using neurotransmitter.
Relay neurone	Allows impulses to travel between sensory and motor neurones in the spinal cord.
Motor neurone	Long axon carries impulse from receptor to effector.
Effector	Muscle or gland that carries out response.



Reflex actions are automatic and rapid; they do not involve the conscious part of the brain and can protect humans from harm.

AQA GCSE HOMEOSTASIS AND RESPONSE PART 2

Response to internal and external change

Controls in the human body	Blood glucose concentration	These automatic control systems may involve nervous responses or chemical responses.
	Body temperature	
	Water levels	

The regulation of internal conditions of a cell or organism to maintain optimum conditions for function.

Homeostasis maintains optimal conditions for enzyme action and all cell functions.

Homeostasis

Water and nitrogen balance (Biology only)

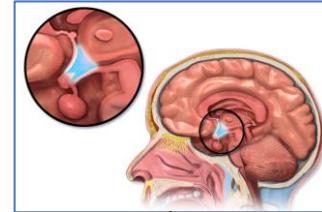
If body cells lose or gain too much water by osmosis they do no function efficiently.	Uncontrolled water/ion/urea loss	Water exhaled in lungs, water, ions and urea in sweat.
	Controlled water/ion/urea loss	Via the kidneys in urine.

Kidney failure is treated by organ transplant or dialysis.

Kidney function	Maintain water balance of the body.	Produce urine by filtration of the blood and selective reabsorption of glucose, ions and water.
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A dialysis machine removes urea from the blood by diffusion while maintaining ion and glucose levels.

(HT only) ADH	Acts on kidney tubules to control water levels.	Released by pituitary gland when blood is too concentrated. Water is reabsorbed back into the blood from the kidney tubules (NEGATIVE FEEDBACK) .
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Thermoregulatory centre (hypothalamus)

Control of body temperature (Biology only)

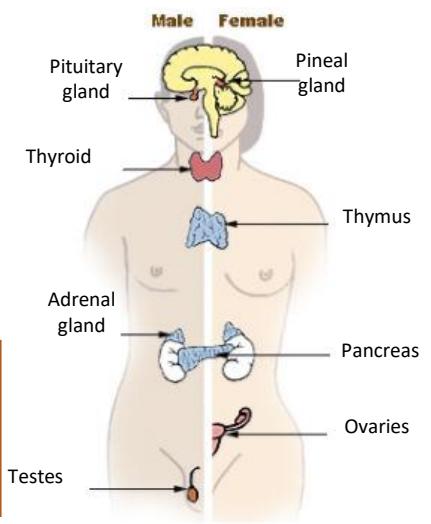
Monitoring body temperature	Thermoregulatory centre	Contains receptors sensitive to the temperature of the blood.
	Skin	Contains temperature receptors, sends nervous impulses to the thermoregulatory centre.

Body temperature	Too high	Blood vessels dilate (vasodilation), sweat produced from sweat glands.
	Too low	Blood vessels constrict (vasoconstriction), sweating stops, muscles contract (shivering).

(HT) Thermal energy is lost from blood near the surface of the skin, sweat evaporates transferring thermal energy.

(HT) Thermal energy loss at the surface of the skin is reduced, respiring muscles cells transfer chemical to thermal energy.

Human endocrine system



Endocrine system	Composed of glands which secrete chemicals called hormones directly into the bloodstream.	The blood carries the hormone to a target organ where it produces an effect. Compared to the nervous system effects are slower but act for longer.
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Pituitary gland	'Master gland'; secretes several hormones into the blood	Stimulates other glands to produce hormones to bring about effects.
------------------------	---	---

Control of blood glucose concentration

Negative feedback (HT only)	Adrenaline	Produced in adrenal glands, increases breathing/heart rate, blood flow to muscles, conversion glycogen to glucose. Prepares body for 'fight or flight'.
	Thyroxine	Produced in the thyroid gland, stimulates the basal metabolic rate. Important in growth and development.

Increasing thyroxine levels prevent the release of thyroid stimulating hormone which stops the release of thyroxine.

Blood glucose concentration	
Monitored and controlled by the pancreas	
Too high	(HT only) Too low
Pancreas produces the hormone insulin, glucose moves from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage.	Pancreas produces the hormone glucagon that causes glycogen to be converted into glucose and released into the blood.

(HT) Rising glucose levels inhibit the release of glucagon in a negative feedback system. Insulin is released to reduce glucose levels and which cause the pancreas to release glucagon

Diabetes	
Type 1	Type 2
Pancreas fails to produce sufficient insulin leading to uncontrolled blood glucose levels. Normally treated by insulin injection.	Obesity is a risk factor. Body cells no longer respond to insulin. Common treatments include changing by diet and increasing exercise.

FSH and LH are used as 'fertility drugs' to help someone become pregnant in the normal way

In Vitro Fertilisation (IVF) treatment.

Involves giving a mother FSH and LH to stimulate the maturation of several eggs

The eggs are collected from the mother and fertilised by sperm from the father in a laboratory.

↓

The fertilised eggs develop into embryos.

↓

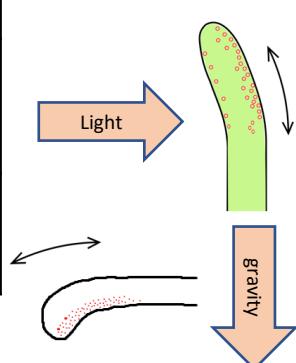
At the stage when they are tiny balls of cells, one or two embryos are inserted into the mother's uterus (womb).

Hormones are used in modern reproductive technologies to treat infertility

Plants produce hormones to coordinate and control growth

Plant responses using hormones (auxins)

Light (phototropism)	Light breaks down auxins and they become unequally distributed in the shoot. The side with the highest concentration of auxins has the highest growth rate and the shoot grows toward the light.
Gravity (geotropism or gravitropism)	Gravity causes an unequal distribution of auxins. In roots the side with the lowest concentration has the highest growth rate and the root grows in the direction of gravity.
	In new shoots from a seedling the unequal distribution of auxins causes the shoot to grow away from gravity.



(HT only) Gibberellins are important in initiating seed germination.

(HT only) Ethene controls cell division and ripening of fruits.

The use of hormone to treat infertility (HT only)

Plant hormones

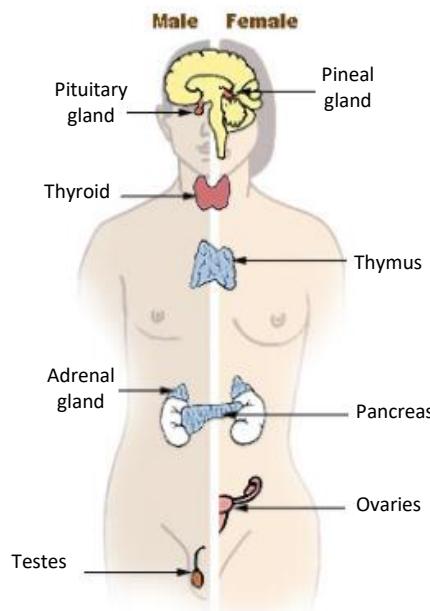
Use of plant hormones (Biology Only)

Plant growth hormones are used in agriculture and horticulture

Auxins	Weed killers, rooting powders, promoting growth in tissue culture.
Ethene	Control ripening of fruit during storage and transport.
Gibberellins	End seed dormancy, promote flowering, increase fruit size.

AQA GCSE HOMEOSTASIS AND RESPONSE PART 3

Hormones in human reproduction



Potential disadvantages of IVF

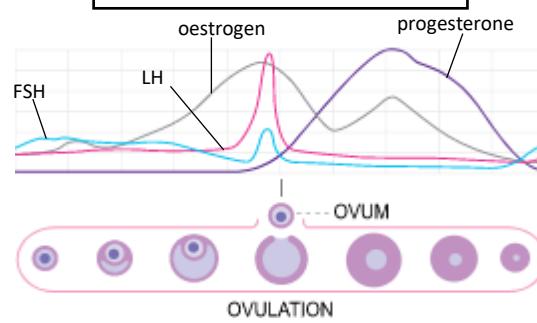
Emotional and physical stress.
Success rates are not high.
Multiple births risk to mother and babies.

Contraception

During puberty reproductive hormones cause secondary sexual characteristics to develop

Oestrogen (main female reproductive hormone)	Testosterone (main male reproductive hormone)
Produced in the ovaries. At puberty eggs begin to mature releasing one every 28 days – ovulation .	Produced in the testes stimulating sperm production.

(HT only) a graph of hormone levels over time

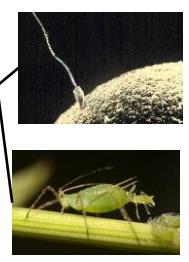


Fertility can be controlled by hormonal and non hormonal methods

Oral contraceptives	Contain hormones to inhibit FSH production so that no eggs mature.
Injection, implant, skin patch	For slow release of progesterone to inhibit the maturation and release of eggs for months or years.
Barrier methods	Condoms or diaphragms which prevent sperm reaching the egg.
Intrauterine devices	Prevent implantation of an embryo or release a hormone.
Spermicidal agents	Kill or disable sperm.
Abstaining	Avoiding intercourse when an egg may be in the oviduct.
Surgery	Male or female sterilisation.

Menstrual cycle

Follicle stimulating hormone (FSH)	Causes maturation of an egg in the ovary.	(HT) FSH stimulates ovaries to produce oestrogen.
Luteinising hormone (LH)	Stimulates release of an egg.	(HT) Oestrogen stops FSH production and stimulates LH production in pituitary gland.
Oestrogen and progesterone	Maintain uterus lining.	

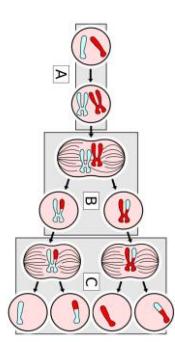


Meiosis halves the number of chromosomes

Gametes are made in reproductive organs (in animals ovaries and testes)

Cells divide by meiosis to form gametes

Copies of the genetic information are made.
The cell divides twice to form four gametes each with single set of chromosomes.
All gametes are genetically different from each other.



Sexual reproduction involves the fusion of male and female gametes.
Asexual reproduction involves only one parent and no fusion of gametes.

Sperm and egg in animals.
Pollen and egg cells in flowering plants.
e.g. cloning of females only in an aphid population.

Produced by meiosis. There is mixing of genetic information which leads to a variety in the offspring.
Only mitosis is involved. There is no mixing of genetic information. This leads to genetically identical clones.

Advantages and disadvantages of sexual and asexual reproduction (Biology only)

Reproduction advantages/disadvantages	
Sexual	Asexual
Needs two parents.	Only one parent needed (quicker).
Produces variation in the offspring.	Identical offspring (no variation).
If the environment changes variation gives a survival advantage by natural selection.	Vulnerable to rapidly changing conditions due to lack of variation.
Negative mutations are not always inherited.	Negative mutation can affect all offspring.
Natural selection can be speeded up using selective breeding to increase food production.	Food/medicine production can be extremely quick.

Gametes join at fertilisation to restore the number of chromosomes

The new cell divides by mitosis. The number of cells increase. As the embryo develops cells differentiate.

When the protein chain is complete it folds to form a unique shape. This allows proteins to do their job as enzymes, hormones or new structures such as collagen.

Meiosis

Meiosis leads to non-identical cells being formed while mitosis leads to identical cells being formed

Some change the shape and affect the function of proteins e.g. and enzyme active site will change or a structural protein loses its strength

Most do not alter the protein so that its appearance or function is not changed.

(HT) Making new proteins (protein synthesis)

Composed of chains of amino acids. A sequence of 3 bases codes for a particular amino acid.

DNA and the genome

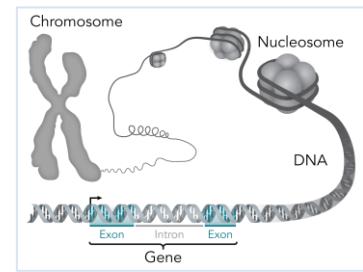
Sexual and asexual reproduction

AQA GCSE INHERITANCE, VARIATION AND EVOLUTION Part 1

Genetic material in the nucleus is composed of a chemical called DNA.

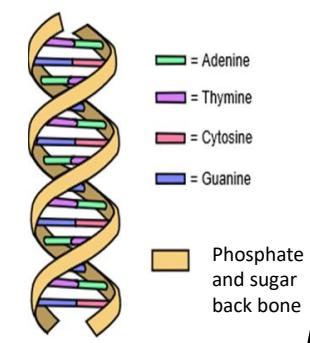


DNA structure
Polymer made up of two strands forming a double helix.
Contained in structures called chromosomes. A gene is a small section of DNA on a chromosome. Each gene codes for a sequence of amino acids to make a specific protein.



The genome is the entire genetic material of an organism.

DNA structure (Biology only)



(HT only) Not all parts code for proteins. Non-coding parts can switch genes on and off. Mutations may affect how genes are expressed.

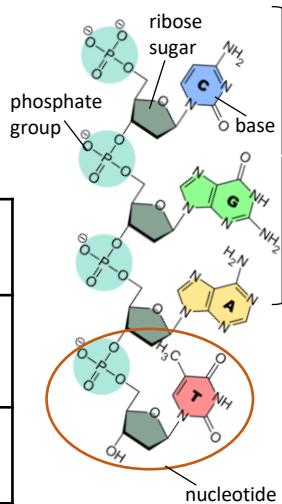
Mutations occur continuously (HT only)

Protein synthesis (HT only)

In DNA the complementary strands C, A, T, G always link in the same way. C always linked to G on the opposite strand and A to T.

DNA is polymer made from four different nucleotides. Each nucleotide consists of a common sugar, phosphate group and one of 4 different bases A, C, G & T

Repeating nucleotide units.



DNA in the nucleus unravels.
↓
Enzymes make a copy of the DNA strand called mRNA.
↓
mRNA moves from the nucleus to ribosome in the cytoplasm.
↓
Ribosomes translate each 3 bases into amino acids according to mRNA template
↓
Ribosomes link amino acids brought by carrier proteins.
↓
A long chain of amino acids form. Their specific order forms a specific protein.

A sequence of 3 bases is the code for a particular amino acid. The order of bases controls the order in which each amino acid is assembled to produce a specific protein.

Some organisms use both methods depending on the circumstances	Malarial parasites	
	Fungi	
	Plants	

Asexually in the human host but sexually in a mosquito.
Asexually by spores, sexually to give variation.
Produce seeds sexually, asexually by runners in strawberry plants, bulbs division in daffodils.

The whole human genome has now been studied.
It is of great importance for future medical developments

Searching for genes linked to different types of disease.
Understanding and treatment of inherited disorders.
Tracing migration patterns from the past.

Embryo screening: small piece of developing placenta removed to check for presence of faulty genes

Gene therapy: replacing the faulty allele in somatic cells with a normal allele

Very rarely a mutation will lead to a new phenotype which if is suited to environmental change can lead to rapid change in the species.

Embryo screening /gene therapy issues	Economic	Costly and not 100% reliable.
	Social	Not available to everyone (due to cost).
	Ethical	Should only 'healthy' embryos be implanted following screening.

Embryo screening and gene therapy may alleviate suffering

Some disorders are inherited. They are caused by the inheritance of certain alleles

Polydactyly	Cystic fibrosis
Caused by inheriting a dominant allele.	Caused by inheriting a recessive allele (both parents have to at least carry it).
Causes a person/animal to have extra toes or fingers.	A disorder of the cell membrane. Patients cannot control the viscosity of their mucus.

Ordinary human body cells contain 23 pairs of chromosomes

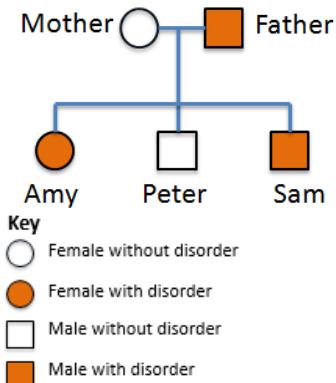
One pair of chromosomes carry the genes that determine sex	
Female	Male
XX	XY
Gametes	X Y
X	XX XY
X	XX XY

The probability of a male of female child is 50%. The ratio is 1:1

Variation: difference in the characteristics of individuals in a population may be due to

Genetic causes (inheritance)	There is usually extensive genetic variation within the population of a species e.g. hair colour, skin colour, height that can also be affected by environment e.g. nutrition, sunlight.
Environmental causes (condition they have developed in)	
A combination of genes and environment	

Using a family tree: if the father was homozygous dominant then all of the offspring would have the disorder. He must be heterozygous



Inherited disorders

Variation

All genetic variation arises in mutation, most have no effect on phenotype, some influence but very few determine phenotype.

The genome and its interaction with the environment influence the development of phenotypes

AQA GCSE INHERITANCE, VARIATION AND EVOLUTION PART 2

Define terms linked to genetics

Gamete	Sex cells produced in meiosis.
Chromosome	A long chain of DNA found in the nucleus.
Gene	Small section of DNA that codes for a particular protein.
Allele	Alternate forms of the same gene.
Dominant	A type of allele – always expressed if only one copy present and when paired with a recessive allele.
Recessive	A type of allele – only expressed when paired with another recessive allele.
Homozygous	Pair of the same alleles, dominant or recessive.
Heterozygous	Two different alleles are present 1 dominant and 1 recessive.
Genotype	Alleles that are present for a particular feature e.g. Bb or bb
Phenotype	Physical expression of an allele combination e.g. black fur, blonde hair, blue eyes.

Some characteristics are controlled by a single gene e.g. fur colour, colour blindness.

The alleles present, or genotype operate at a molecular level to develop characteristics that can be expressed as a phenotype.

Most characteristics are as a result of multiple genes interacting.

Genetic inheritance

The concept of probability in predicting results of a single gene cross.	
Dominant and recessive allele combinations	
Dominant	Recessive
Represented by a capital letter e.g. B.	Represented by a lower case letter e.g. b.
3 possible combinations: Homozygous dominant BB Heterozygous dominant Bb Homozygous recessive bb	

Sex determination

Using a punnet square (using mouse fur colour as an example)											
Parent phenotype	Black fur	White fur									
Parent genotype	BB	bb									
What gametes are present	In each egg B B	In each sperm b b									
<table border="1"> <tr> <td>Gametes</td> <td>b</td> <td>b</td> </tr> <tr> <td>B</td> <td>Bb</td> <td>Bb</td> </tr> <tr> <td>B</td> <td>Bb</td> <td>Bb</td> </tr> </table>			Gametes	b	b	B	Bb	Bb	B	Bb	Bb
Gametes	b	b									
B	Bb	Bb									
B	Bb	Bb									

The probability of black fur offspring phenotype is 100%. All offspring genotypes are heterozygous (Bb).

Crossing two heterozygous mice (Bb)		
Gametes	B	b
B	BB	Bb
b	Bb	bb

The probability of black fur is 75% and white fur 25%. The ratio of black to white mice is 3:1

Over time this results in the formation of new species.

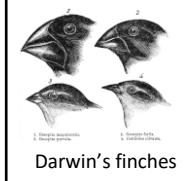
The theory of evolution by natural selection.

Species of all living things have evolved from simple life forms that first developed 3 billion years ago.

Through natural selection of variants (genotypes) that give rise to phenotypes best suited to their environment or environmental change e.g. stronger, faster. This allows for variants to pass on their genotype to the next generation.



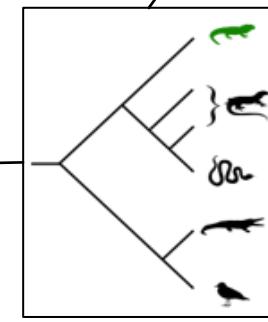
If two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring they have formed two new species.



Classification of living organisms

Evolutionary trees are a method used by scientists to show how organisms are related

Use current classification data for living organisms and fossil data for extinct organisms



Choosing characteristics

Desired characteristics are chosen for usefulness or appearance

Disease resistance in food crops.



Animals which produce more meat or milk.



Domestic dogs with a gentle nature.



Large or unusual flowers.



Concern: effect of GMO on wild populations of flowers and insects.



Selective breeding can lead to 'inbreeding' where some breeds are particularly prone to disease or inherited defects e.g. British Bulldogs have breathing difficulties.

A change in the inherited characteristics of a population over time through the process of natural selection.

Evolution

Humans have been doing this for thousands of years since they first bred food from crops and domesticated animals.

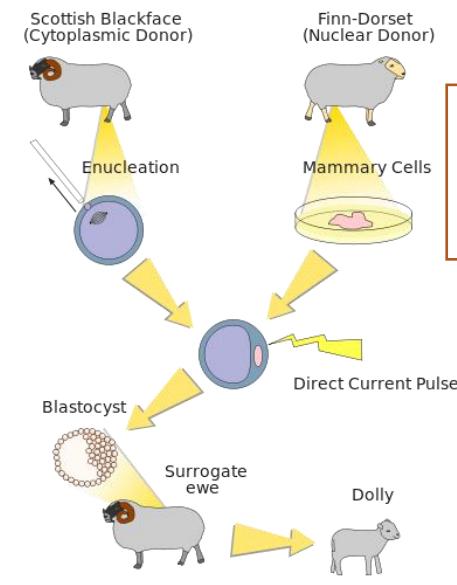
The process by which humans breed plants/animals for particular genetic characteristics

Selective breeding

Genetic engineering

AQA GCSE INHERITANCE VARIATION AND EVOLUTION PART 3

Cloning (Biology only)

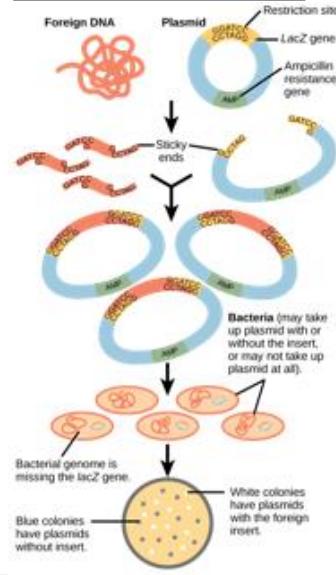


Cloning techniques in plants/animals

Tissue culture	Small groups of cells to grow new plants. Important for preservation of rare plants and commercially in nurseries.
Cuttings	Part of a plant is cut off and grown into full plant.
Embryo transplants	Splitting apart cells from animals embryo before they become specialised. New clone embryos are inserted into womb of adult female.

Concern: some people have ethical objections to adult cell cloning e.g. welfare of the animals.

Modern medical is exploring the possibility of GM to overcome inherited disorders e.g. cystic fibrosis



Selective breeding

Choosing parents with the desired characteristics from a mixed population

Chosen parents are bred together.

From the offspring those with desired characteristics are bred together.

Repeat over several generations until all the offspring show the desired characteristics.

Concern: effect of GMO on human health not fully explored

Genetic engineering process (HT only)

1. Enzymes are used to isolate the required gene.
2. Gene is inserted into a vector – bacterial plasmid or virus.
3. Vector inserts genes into the required cells.
4. Genes are transferred to plants/animals/microbes at an early stage of development so they develop the required characteristics.

Genes from the chromosomes of humans or other organisms can be 'cut out' and transferred to the cells of other organisms.

Genetically modified crops (GMO)	<i>Crops that have genes from other organisms</i>	To become more resistant to insect attack or herbicides.
		To increase the yield of the crop.

- Adult cell cloning**
1. Nucleus is removed from an unfertilised egg.
 2. Nucleus from body cell is inserted into egg cell.
 3. An electric shock stimulates the egg to divide into an embryo
 4. Embryo cells are genetically identical to adult cells.
 5. When embryo has developed into ball of cells it is inserted into host womb.



Charles Darwin

Theory of evolution by natural selection.

Individual organisms within a particular species show a wide range of variation for a characteristic.

Individual most suited to the environment are more likely to breed successfully.

Characteristics enable individuals to survive are then passed on to the next generation.

Developed since its proposal from information gathered by other scientists.

Did much pioneering work on speciation but more evidence over time has led to our current understanding.

Allows biologists to understand the diversity of species on the planet.



Alfred Wallace

Independently proposed the theory of evolution by natural selection

Published joint writings with Darwin in 1858.

Worked worldwide gathering evidence.

Best known for work on warning colouration in animals and his theory of speciation.

Evidence from around the world, experimentation, geology, fossils, discussion with other scientists (Alfred Wallace) lead to:

Charles Darwin 'On the Origin of the Species' (1859)

Published the theory of evolution by natural selection

Slowly accepted; challenged creation theory (God), insufficient evidence at time, mechanism of inheritance not yet known.

Theory of evolution (Biology only)

Speciation (Biology only)

AQA GCSE INHERITANCE VARIATION AND EVOLUTION PART 4

Other theories e.g. Lamarckism are based on the idea that changes occur in an organism during its lifetime which can be inherited. We now know that in the vast majority of cases this cannot occur.

The full human classification

Classification of living organisms

Carl Linnaeus classified living things	Kingdom	Animalia
	Phylum	Chordata
	Class	Mammalia
	Order	Primates
	Family	Hominidae
	Genus	<i>Homo</i>
	Species	<i>sapiens</i>

Due to improvements in microscopes, and the understanding of biochemical processes, new models of classification were proposed.

Carl Woese

3 domain based on chemical analysis.

Archaea (primitive bacteria), true bacteria, eukaryota.

Organisms are named by the binomial system of genus and species. Humans are *Homo sapiens*

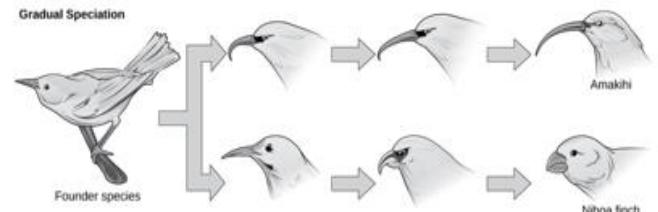
Evidence for evolution

The understanding of genetics (biology only)

Gregor Mendel

In the mid 19th century carried out breeding experiments on plants

Inheritance of each characteristic is determined by units that are passed on to descendants unchanged.



Speciation

Due to isolation of a population of a species e.g. species are split across far apart islands.

Environmental conditions differ for populations e.g. types of food available, habitat.

Individuals in each population most suited to their environments are more likely to breed successfully.

Over long periods of time each population will have greater differences in their genotype.

If two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring they have formed two new species.

Fossils and antibiotic resistance in bacteria provide evidence for evolution.

Antibiotic resistant bacteria

Mutations produce antibiotic resistant strains which can spread

Resistant strains are not killed.

Strain survives and reproduces.

People have no immunity to strain and treatment is ineffective.

Extinction

When no members of a species survive

Due to extreme geological events, disease, climate change, habitat destruction, hunting by humans.



Fossils tell scientists how much or how little different organisms have changed over time.

Fossils

'remains' of ancient organisms which are found in rocks

Parts of organism that have not decayed as necessary conditions are absent.

Parts of the organism replaced by minerals as they decay.

Preserved traces of organisms such as footprints, burrows and rootlet traces.

Early forms of life were soft bodied and few traces are left behind and have been destroyed by geological activity, cannot be certain about how life began.

Led to gene theory being developed but not until long after Mendel died.

Further understanding of genetics

Improving technology allowed new observations.

Late 19th century: behaviour of chromosomes in cell division.

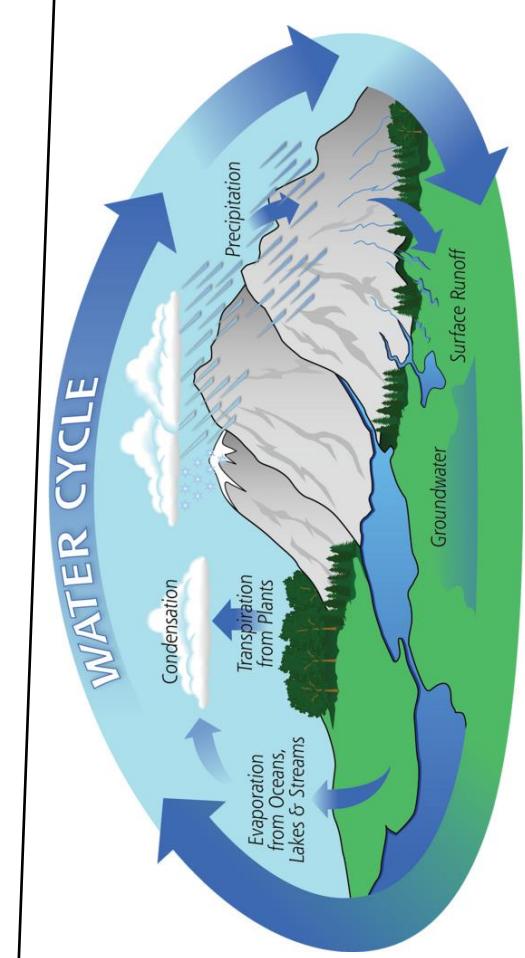
Early 20th century: chromosomes and Mendel's 'units' behave in similar ways. 'units' now called genes must be located on chromosomes.

Mid 20th century: structure of DNA determined. Mechanism of gene function worked out.

Evolution is widely accepted. Evidence is now available as it has been shown that characteristics are passed on to offspring in genes.

Farmers optimise conditions for making compost for use as a natural fertiliser.

Anaerobic decay in biogas generators produces methane gas, used as a fuel.



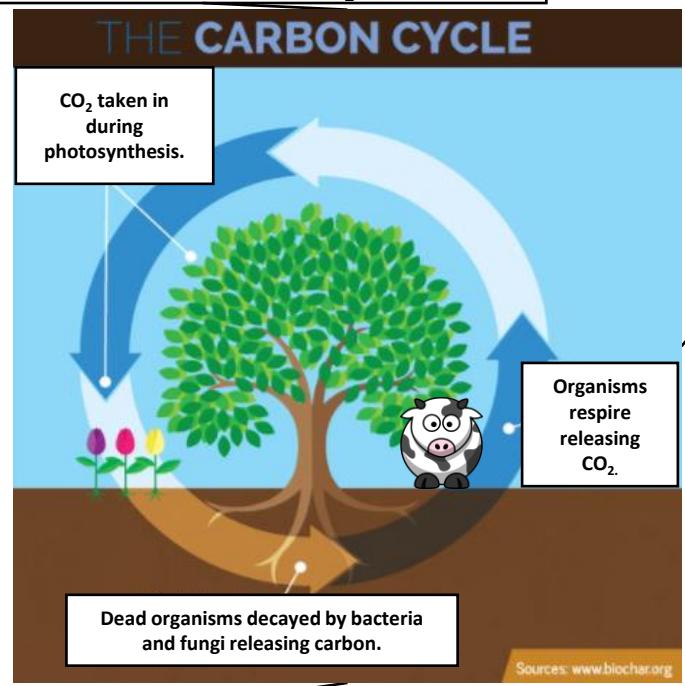
Factors affecting rate of decay
Temperature, water, oxygen
Increase the rate of decay. In enzyme controlled reactions raising the temperature too high will denature the enzymes.

Breakdown of dead organisms releases mineral ions can into the soil.

Ecosystem	Environment	The conditions surrounding an organism; abiotic and biotic.
	Habitat	Place where organisms live e.g. woodland, lake.
	Population	Individuals of a species living in a habitat.
	Community	Populations of different species living in a habitat.

Organisms require a supply of materials from their surroundings and from the other living organisms.

Bacteria respire when breaking down dead organisms releasing CO₂.



Materials are recycled to provide the building blocks for future organisms

Photosynthetic organisms are the producers of biomass for life on Earth

Food chains			
Feeding relationships in a community			
Producer	Primary consumer	Secondary consumer	Tertiary consumer
			
Grass → Grasshopper → Mouse → Owl			
All food chains begin with a producer e.g. grass that is usually a green plant or photosynthetic algae.		Consumers that kill and eat other animals are predators and those eaten are prey.	

Surviving and reproducing	Competition	Plants in a community or habitat compete with each other for light, space, water and mineral ions. Animals compete with each other for food, mates and territory.
	Interdependence	Species depend on each other for food, shelter, pollination, seed dispersal etc. Removing a species can affect the whole community

EXAMPLE: Introduction of grey squirrels to UK increased competition for food for red squirrels. The greys also carry a pathogen that kills reds.

EXAMPLE: climate change is leading to more dissolved CO₂ in oceans lowering the pH of the water affecting organisms living there.

Decomposition and material cycling

Interdependence and competition

AQA GCSE ECOLOGY PART 1

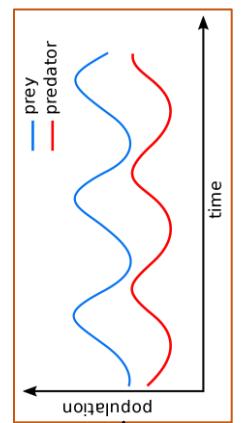
Levels of organisation

Organisms adaptations enable them to survive in conditions where they normally live.

Abiotic and biotic factors.

Abiotic	Biotic
<i>Non-living factors that affect a community</i>	<i>Living factors that affect a community</i>
Living intensity.	Availability of food.
Temperature.	New predators arriving.
Moisture levels.	
Soil pH, mineral content.	New pathogens.
Wind intensity and direction.	
Carbon dioxide levels for a plant.	One species outcompeting so numbers are no longer sufficient to breed
Oxygen levels for aquatic organisms.	

Adaptations may be structural, behavioural or functional.



In a stable community the numbers of predators and prey rise and fall in cycles.

Adaptations		
Plants	Animals	Extremophiles
Cactus in dry, hot desert	Polar bear in extreme cold artic	Deep sea vent bacteria
		
No leaves to reduce water loss, wide deep roots for absorbing water.	Hollow hairs to trap layer of heat. Thick layer of fat for insulation.	Populations form in thick layers to protect outer layers from extreme heat of vent.

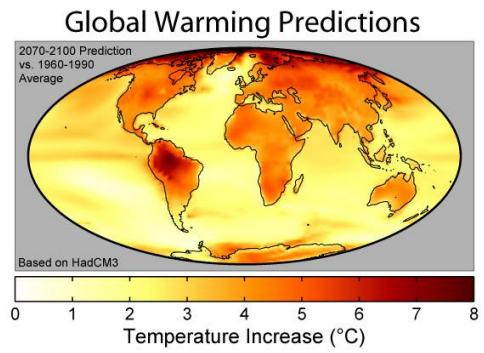
Factors affecting food security	<i>Enough food is needed to feed a changing population</i>	Increasing birth rate.
		Changing diets in developing countries.
		New pests and pathogens affecting farming.
		Environmental changes e.g. famine when rains fail.
		Cost of agriculture input.
		Conflicts (war) affecting water of food availability

Global warming

Levels of CO₂ and methane in the atmosphere are increasing.

Decreased land availability from sea level rise, temperature rise damages delicate habitats, extreme weather events harm populations of plants and animals.

There is a global consensus about global warming and climate change based on systematic reviews of thousands of peer reviewed publications.



Global warming

Food production (biology only)

AQA GCSE ECOLOGY PART 2

Maintaining biodiversity

Human activity can have a positive impact on biodiversity

Scientists and concerned citizens

Put in place programmes to reduce the negative impacts of humans on ecosystems and biodiversity

Breeding programmes for endangered species.

Protection and regeneration of rare habitats.

Reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop.

Reduction of deforestation and CO₂ emissions by some governments.

Recycling resources rather than dumping waste in landfill.

Some of the programmes potentially conflict with human needs for land use, food production and high living standards.

Farming techniques

Increasing efficiency of food production

Reduce energy waste, limiting movement, control temperature, high protein diet to increase growth.



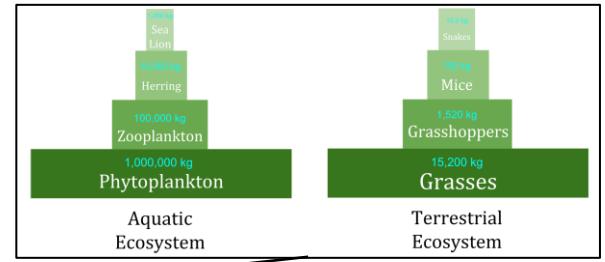
Sustainable fisheries

Fish stocks in oceans are declining

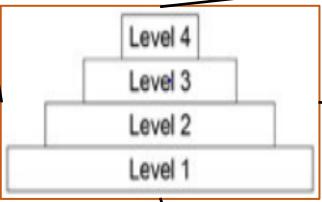
Maintain/grow fish stocks to a sustainable level where breeding continues or certain species may disappear. By controlling net size, fishing quotas.



Trophic levels and biomass (biology only)



Some people have concerns about the treatment of animals.



Trophic levels can be represented by numbers and biomass in pyramids.

Trophic levels are numbered sequentially according to how far the organisms is along the food chain.

Level 1	Producers	Plants and algae.
Level 2	Herbivores	Primary consumers.
Level 3	Carnivores	Secondary consumers.
Level 4	Carnivores	Tertiary consumers.

Apex predators are carnivores with no predators.

Biotechnology

Meeting the demands of a growing population

Fungus *Fusarium* to produce mycoprotein. Requires glucose syrup, aerobic conditions. Biomass is harvested and purified.

GM bacterium produces insulin to treat diabetes.

GM crops to provide more/nutritional food (golden rice).



Decomposers break down dead plants and animal matter by secreting enzymes. Small soluble food molecules than diffuse into the microorganism.

Transfer of biomass

Biomass is lost between the different trophic levels

Producers transfer about 1% of the incident energy from light for photosynthesis.

Approximately 10% of the biomass from each trophic level is transferred to the level above.

Large amounts of glucose is used in respiration, some material egested as faeces or lost as waste e.g. CO₂, water and urea in urine.

Maintain a great biodiversity	Ensures the stability of ecosystems	By reducing the dependence on one species on another for food, shelter, maintenance of the physical environment.
	Future of human species	Many human activities are reduction biodiversity and only recently measures have been taken to stop it.

Human activity can have a negative impact on biodiversity



Pollution kills plants and animals which can reduce biodiversity.

Biodiversity is the variety of all different species of organisms on Earth, or within an ecosystem

Biodiversity

Biodiversity and the effect of human interaction on the ecosystem

Waste management	Rapid growth in human population and higher standard of living	More resources used and more waste produced.
		Pollution in water; sewage, fertiliser or toxic chemicals.
		Pollution in air; smoke or acidic gases.
		Pollution on land; landfill and toxic chemicals.

Experimental methods are used to determine the distribution and abundance of a species.



Sampling techniques	Quadrats	Organisms are counted within a randomly placed square
	Transects	Organisms are counted along a belt (transect) of the ecosystem.



AQA GCSE ECOLOGY PART 3

Waste, land use and deforestation

Land use
<i>Humans reduce the amount of land and habitats available for other plants, animals and microorganisms.</i>
Building and quarrying.
Farming for animals and food crops.
Dumping waste.
Destruction of peat bogs to produce cheap compost for gardeners/farmers to increase food production.



Impact of environmental change (Biology HT only)

Processing data	
Median	Middle value in a sample.
Mode	Most occurring value in a sample.
Mean	The sum of all the value in a sample divided by the sample number.

Large scale deforestation
<i>In tropical areas (e.g. rain forest) has occurred to:</i>
Provide land for cattle and rice fields, grow crops for biofuels.

The decay or burning of peat release CO₂ into the atmosphere.

This conflicts with conserving peat bogs and peatlands as habitats for biodiversity and reduce CO₂ emissions.



Environmental changes affect the distribution of species	Temperature	These changes might be seasonal, geographic or caused by human interaction.
	Availability of water	
	Composition of atmospheric gases	

Example: Several species of bird migrate from cold winter conditions to warmer conditions closer to the equator.

Deforestation reduces biodiversity and removes a sink for increasing the amount CO₂ in the atmosphere.